Attorney Docket No. 011670.00006 PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	**Lifson, A.**	**Group Art Unit:**	**3744**
Serial No.:	**09/921,334**	**Examiner:**	**Norman, Marc E.**
Filed:	**August 03, 2001**		
For:	**PULSED FLOW FOR CAPACITY CONTROL**		
Original Filing Date:	**December 8, 1997**		
Original Patent No:	**6,047,556**		
Granted:	**April 11, 2000**		

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DECLARATION UNDER 37 C.F.R. § 1.132

I, James William Bush, declare as follows:

1. I am a Senior Program Manager in the Carlyle Compressor Division with United Technologies Carrier Corporation and have studied the specification and claims of the above-referenced reissue application, as well as U.S. 4,132,086 issued to Kountz and U.S. 5,226,472 issued to Benevelli et al.
2. I received a Bachelor of Science in Mechanical Engineering from Tennessee Technological University in March 1979 and a Master of Science in Mechanical Engineering from Tennessee Technological University in December 1982. I am a Licensed Professional Engineer.
3. From July 1998 to present, I have been employed by United Technologies Carrier Corporation, assignee of the above-referenced patent and reissue application.
4. I have over twenty-four (24) years of experience in directed research, design, development and mass production of precision rotating electromechanical machinery emphasizing small positive displacement equipment such as compressors, pumps, blowers, and expanders. I have had a lead role in seven major product programs, five of which have led to mass-produced commercial products.

5. I am an author or co-author on sixteen (16) publications related to electromechanical machinery such as, for example, compressor technologies. A full citation of each publication is listed on my *curriculum vitae*, a copy of which is attached as Exhibit A to this paper.
6. I am an inventor or co-inventor of sixty-four (64) issued United States Patents. A full citation of each United States Patent is listed on my *curriculum vitae*, a copy of which is attached as Exhibit A to this paper.
7. I have studied each of the patents (U.S. 4,132,086 issued to Kountz and U.S. 5,226,472 issued to Benevelli et al.) cited by the Examiner in the Office Action for the above-referenced reissue application and for the following reasons conclude:

   (i) that each patent or any combination of the patents cited by the Examiner fails to disclose, teach or suggest any valve which is operative to cycle with a cycling time shorter than the response time of the system; and

   (ii) each patent or any combination of the patents fails to disclose, teach or suggest any valve that is operative to cycle between a fully open and a fully closed position.

I. Kountz fails to Disclose, Teach or Suggest <u>the Subject Matter of Any of Claims 4, 5, 8, 9, 12, 14, 33 and 34</u>

For the reasons below, I conclude that Kountz fails to disclose, teach or suggest all the elements of any of claims 4, 5, 8, 9, 12, 14, 33 and 34. In particular, Kountz fails to expressly disclose any port whatsoever. Kountz also fails to disclose cycling a valve with a cycling time shorter than the response time of the system.

The Examiner asserts that Kountz cycles a valve less than the time constant of the load on the compressor since the valve is pulsed on and off repeatedly in order to adjust the stroke of the compressor. I respectfully disagree.

The disclosure of Kountz fails to recite expressly any step of cycling a valve with a cycling time shorter than the response time of the system to modulate compressor

capacity. Though Kountz may pulse a valve on and off, there is no teaching in Kountz of cycling a valve using a cycling time shorter than the response time of the system. That is, in view of the disclosure of Kountz, I do not find that Kountz cycles any valve with a cycling time shorter than the response time of the system.

Instead, Kountz uses a special compressor (Kountz references US 3,861,829 which discloses the special compressor), which produces variable capacity using an internal mechanism that varies compressor displacement in response to crankcase pressure. That is, Kountz regulates crankcase pressure to control the compressor displacement. In the methods used by Kountz, compressor capacity, and thus the refrigerant flow through the system, is controlled to a steady value at a given operating condition.

Because the methods of Kountz operate by varying compressor displacement in response to crankcase pressure, the refrigerant flow in the methods of Kountz is not pulsed in any manner. Further, because the refrigerant flow is not pulsed, Kountz would never even contemplate issues such as, for example, the response time of the system, cycling a valve with a cycling time shorter than the response time of the system, or cycling a valve between a fully open position and a fully closed position. That is, because the method of Kountz regulates crankcase pressure to control compressor displacement, Kountz would have no motivation to even contemplate the response time of the system. Accordingly, the methods of Kountz are strikingly different from the subject matter of claims 4, 5, 8, 9, 12, 14, 33 and 34.

Further, each of claims 4, 5, 8, 9, 12, and 14 recite at least one port. Kountz fails to even mention that his temperature control system includes a port. Thus, clearly Kountz does not teach all the elements of claims 4, 5, 8, 9, 12 and 14.

Claims 33 and 34 recite cycling a valve using a cycling time shorter than the response time of the system to modulate compressor capacity. As discussed above, Kountz fails to discuss any cycling time for his temperature control system or cycling a valve using a cycle time shorter than the response time of the system. Thus, Kountz fails to teach all the elements of claims 33 and 34.

For the reasons above, I find that Kountz fails to disclose, teach or suggest all the elements of the claims, and, thus, Kountz cannot anticipate any of claims 4, 5, 8, 9, 12, 14, 33 or 34.

II. The combination of Kountz and Benevelli et al. Does Not Render Claims 6, 7, 10, 11 and 15 Obvious

For the reasons below, I conclude that the combination of Kountz and Benevelli et al. fails to disclose, teach or suggest the subject matter of any of claims 6, 7, 10, 11 and 15. In particular, the combination of Kountz and Benevelli et al. fails to disclose, teach or suggest cycling a valve with a cycling time shorter than the response time of the system.

As discussed above, Kountz differs greatly from the subject matter of the present claims. Briefly, the method of Kountz regulates crankcase pressure to control compressor displacement, and, therefore, Kountz would have no motivation to even consider the response time of the system or cycling a valve with a cycling time shorter than the response time of the system.

Benevelli et al. fails to cure the deficiencies of Kountz. Instead, Benevelli et al. discloses pulse width modulation to regulate electric power supplied to a heater. While Benevelli et al. refers to controlling system capacity by regulating refrigerant flow through a valve which acts in response to a pulse width modulated signal, this teaching of Benevelli et al. does not involve cycling a valve. In fact, the valve used in Benevelli et al. is not cycled. Instead, the valve used by Benevelli et al. is a continuously modulating throttle valve.

Benevelli et al.'s use of a continuously modulating throttle valve to regulate capacity does not involve consideration of the response time of the system. In implementing Benevelli et al., one skilled in the art would not consider the response time of the system. It necessarily follows, therefore, that one skilled in the art would not consider cycling a valve with a cycle time shorter than the response time of the system or cycling a valve between a fully open position and a fully closed position. Accordingly, the methods of Benevelli et al. are strikingly different from the subject matter of the

present reissue claims, and, therefore, the combination of Kountz and Benevelli et al. fails to render obvious the subject matter of any of the reissue claims.

Neither Kountz nor Benevelli et al. pulse or otherwise regulate refrigerant flow in a discontinuous fashion. They both use discontinuous control signals to achieve continuous modulation for smooth, continuous refrigerant flow. Therefore, the teachings of both Kountz and Benevelli et al. differ greatly from the subject matter of the present invention.

Each of claims 6 and 7 depends directly or indirectly from claim 4, which recites an air conditioning or refrigeration system comprising at least one port and also recites cycling a valve with a cycling time shorter than the response time of the system. As discussed above, the methods of Kountz and Benevelli et al. are strikingly different from the methods and apparatus of the present invention. That is, the combination of Kountz and Benevelli et al. does not disclose, teach or suggest the subject matter defined by claims 6 and 7. In particular, the combination of Kountz and Benevelli et al. does not disclose, teach or suggest cycling a valve with a cycling time shorter than the response time of the system. Accordingly, claims 6 and 7 are not rendered obvious by the combination of Kountz and Benevelli et al.

Each of claims 10 and 11 depends directly or indirectly from claim 9. Claim 9 recites an air conditioning or refrigeration system comprising at least one port and a valve operative to cycle with a cycling time shorter than the response time of the system. As discussed above, because the teachings of each of Kountz and Benevelli et al. differs so greatly from the subject matter of the present claims, the combination of Kountz and Benevelli et al. fails to render obvious any of the claims. That is, the combination of Kountz and Benevelli et al. fails to disclose, teach or suggest cycling a valve with a cycling time shorter than the response time of the system. Accordingly, the subject matter of either of claims 10 or 11 is not disclosed, taught or suggested by Kountz and Benevelli et al.

Claim 15 depends from claim 14. Claim 14 recites an air conditioning or refrigeration system comprising a compressor having at least one port and a solenoid valve operative to cycle between a fully open and a fully closed position. As discussed

above, because the teachings of each of Kountz and Benevelli et al. differs so greatly from the subject matter of the present claims, the combination of Kountz and Benevelli et al. fails to render obvious any of the claims. That is, the combination of Kountz and Benevelli et al. does not disclose, teach or suggest an air conditioning or refrigeration system comprising a compressor having at least one port and cycling a valve between fully open and fully closed positions to modulate compressor capacity. Therefore, the combination of Kountz and Benevelli et al. fails to render obvious the subject matter of claim 15.

Because the combination of Kountz and Benevelli et al. fails to disclose, teach or suggest the subject matter of any of claims 6, 7, 10, 11 and 15, I find that the combination of Kountz and Benevelli et al. does not render any of claims 6, 7, 10, 11 and 15 obvious.

V. <u>Claims 17-19 are not Obvious over Kountz</u>

For the reasons below, I conclude that Kountz fails to render obvious any of claims 17-19.

The Examiner asserts that Kountz cycles a valve less than the time constant of the load on the compressor since the valve is pulsed on and off repeatedly in order to adjust the stroke of the compressor. I respectfully disagree.

As discussed above, the methods of Kountz are strikingly different from the methods and apparatus of the present claims. Kountz uses a special compressor to vary compressor displacement in response to crankcase pressure. That is, Kountz regulates crankcase pressure to control the compressor displacement. Because the methods of Kountz operate by varying compressor displacement in response to crankcase pressure, the refrigerant flow in the methods of Kountz is not pulsed in any manner. Further, because the refrigerant flow is not pulsed, Kountz would never consider issues such as, for example, the response time of the system, cycling a valve with a cycling time shorter than the response time of the system, or cycling a valve between a fully open position and a fully closed position. That is, because the method of Kountz regulates crankcase pressure to control compressor displacement, Kountz would not even contemplate the response time of the system. Thus, the disclosure of Kountz fails to disclose, teach or

suggest any step of cycling a valve with a cycling time shorter than the response time of the system to modulate compressor capacity.

Each of claims 17-19 recites a refrigeration injection port, a refrigeration discharge port and a valve that is cycled with a cycling time shorter than the response time of the system. As discussed above, Kountz fails to disclose, teach or suggest cycling a valve with a cycle time shorter than the response time of the system. Accordingly, Kountz cannot render any of claims 17-19 obvious.

VI. Kountz in view of Benevelli et al. does not render <u>Claims 18, 21, 24, 25, 27, 33, 35, 36 and 38 are Obvious</u>

For the reasons below, I conclude that the combination of Kountz and Benevelli et al. fails to render obvious any of claims 18, 21, 24, 25, 27, 33, 35, 36 and 38. As discussed above, each of the teachings of Kountz and Benevelli et al. is strikingly different from the subject matter of the present claims.

Kountz uses a special compressor to vary compressor displacement in response to crankcase pressure. That is, Kountz regulates crankcase pressure to control the compressor displacement. Because the methods of Kountz operate by varying compressor displacement in response to crankcase pressure, the refrigerant flow in the methods of Kountz is not pulsed in any manner. Further, because the refrigerant flow is not pulsed, Kountz would never consider issues such as, for example, the response time of the system, cycling a valve with a cycling time shorter than the response time of the system or cycling a valve between a fully closed and a fully open position. That is, because the method of Kountz regulates crankcase pressure to control compressor displacement, the response time of the system would not be considered by Kountz.

Benevelli et al. fails to cycle any valve at all. Instead, the valve used by Benevelli et al. is a continuously modulating throttle valve. The use of a continuously modulating throttle valve does not involve consideration of the response time of the system. That is, in applying the methods used by Benevelli et al., the response time of the system would never be considered nor should it be.

Each of claims 18 and 21 depend from claim 17. Claim 17 recites a capacity modulated compressor comprising a compressor having at least one port and a valve operative to cycle with a cycling time shorter than the response time of the system to modulate compressor capacity. As discussed above, the combination of Kountz and Benevelli et al. fails to disclose, teach or suggest a valve operative to cycle with a cycling time shorter than the response time of the system to modulate compressor capacity. Thus, claims 18 and 21 are not obvious over Kountz and Benevelli et al.

Claim 24 recites a capacity modulated compressor comprising at least one port and a solenoid valve operative to cycle between a fully open position and a fully closed position to modulate compressor capacity. The combination of Kountz and Benevelli et al. fails to disclose, teach or suggest a valve operative to cycle between a fully open position and a fully closed position to modulate compressor capacity. Thus, claim 24 is not obvious over the combination of Kountz and Benevelli et al.

Each of claims 25 and 27 depends directly or indirectly from claim 24. Thus, each of claims 25 and 27 are not rendered obvious by the combination of Kountz and Benevelli et al. for at least the same reasons.

Claim 33 recites a method of modulating the capacity of a compressor comprising cycling a valve using a cycling time shorter than the response time of the system to modulate compressor capacity. As discussed above, the combination of Kountz and Benevelli et al. fails to disclose, teach or suggest a valve operative to cycle with a cycling time shorter than the response time of the system to modulate compressor capacity. Thus, claim 33 is not obvious over the combination of Kountz and Benevelli et al.

Claim 35 recites a method of modulating the capacity of a compressor by rapidly cycling a solenoid valve, disposed in a refrigerant line upstream of a port, between its fully open and fully closed position to modulate compressor capacity. The combination of Kountz and Benevelli et al. fails to disclose, teach or suggest cycling a solenoid valve, disposed in a refrigerant line upstream of a port, between its fully open and fully closed position to modulate compressor capacity. Thus, claim 35 is not obvious over the combination of Kountz and Benevelli et al.

Claims 36 and 38 each depends directly or indirectly from claim 35. Thus, claims 36 and 38 are not rendered obvious by Kountz in view of Benevelli et al. for at least the same reasons.

Therefore, because the combination of Kountz and Benevelli et al. fails to disclose, teach or suggest the subject matter of any of claims 18, 21, 24, 25, 27, 33, 35, 36 and 38, I find that the combination of Kountz and Benevelli et al. does not render any of claims 18, 21, 24, 25, 27, 33, 35, 36 and 38 obvious.

8. Based on the foregoing reasons, I conclude the subject matter of any of the reissue claims 4-38 is not anticipated by or rendered obvious by Kountz or the combination of Kountz and Benevelli et al.

9. I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true and further that these statements were made with knowledge that willful false statements, and the like, so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the above-referenced reissue application or any patent issuing thereon.

Date: July 30, 2002

James William Bush

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Brief

Twenty-four year career (nineteen in program management) in directed research, design, development, and mass production of precision rotating electromechanical machinery emphasizing small positive displacement equipment such as compressors, pumps, blowers, and expanders. Lead role in seven major product programs, five which have gone to market, and many smaller projects. Technical skills reflected by sixteen publications and sixty-four issued U.S. Patents.

Formal Education

Master of Science in Mechanical Engineering, December 1982, Tennessee Technological University, Cookeville, Tennessee.
Machine design, engineering acoustics (thesis), fluid mechanics, and dynamic fluid machinery.

Bachelor of Science in Mechanical Engineering, March 1979, Tennessee Technological University, Cookeville, Tennessee.

West Rome High School, 1973, Rome, Georgia.

Honor Societies:

Kappa Mu Epsilon	(Mathematics)
Tau Beta Pi	(Engineering)
Pi Tau Sigma	(Mechanical Engineering)

Licensed Professional Engineer, State of Ohio, Reg. No. E-51800.

Work Experience

July 1988 – Present
United Technologies Carrier Corporation, Carlyle Compressor Division
Syracuse, New York.

June 1998 – Present
Senior Program Manager, Hermetic Compressor Engineering.
Development and support of rotary and scroll products. Emphasis on transport refrigeration products – introduced "RSH105GA" Refrigeration Scroll. Close coordination with domestic and French development partners and manufacturers. Also continued Advanced Compression activities.

July 1994 – June 1998
Senior Program Manager, Advanced Compression Technology.
Directed research and advanced development of compressor technology and products including standing vane rotary, scroll, twin screw, reciprocating and others. Oversight of programs at UT Research Center and M.I.T. including external budgets. Technical support for domestic and overseas suppliers. Divisional support of intellectual property administration.

Mar. 1993 – July 1994
Senior Program Manager, Screw Compressor Engineering.
Development of 80 ton high speed oil flooded twin screw compressor. Technical supervision on design, sourcing, and qualification of new supplier for hermetic induction motors. Worked directly with domestic and overseas suppliers and customers.

Jan. 1991 – Mar. 1993
Program Manager, Commercial Scroll Development.
Managed all aspects of 15 ton product development program, including design, machining, and assembly engineering, supplier selection, factory planning and layout, manufacturing investment, cost estimation, budget administration, and financial analysis.

Jan. 1990 – Jan. 1991
Program Manager, Rotary Compressor Engineering.

Apr. 1989 – Jan. 1990
Project Leader, Rotary Compressor Engineering.
Product engineering and support for ½ to 2 ½ ton compressors made at Korean JV. Added six staff to more than double department. Co-founded program to train Korean engineers in U.S. Domestic and overseas supplier and customer support. Also managed divisional sound labs.

Mar. 1984 July 1988	**Copeland Corporation, Sidney, Ohio.**
Sept. 1986 July 1988	**Manager, New Products Design and Analysis.** Chief design engineer for development and first-year production startup of "ASPEN" (K1) scroll compressor. Close support of suppliers, machining and assembly engineering, marketing, purchasing, quality control, and reliability organizations. Later, managed expanded staff for initial design of "QUEST" (K2 and K3) compressor products.
Nov 1985 Sept 1986	**Senior Project Engineer, New Products.** Lead engineer on "ASPEN" scroll program. Mechanical design, performance and durability development. Also software development for computerized analysis of inspection data, performance modeling, design optimization, and dynamic balancing. Indirect engineering and design staff.
Mar. 1984 Nov. 1985	**Senior Project Engineer, Research.** Advanced compressor development. Indirect design and lab staff. Computer program development for load analysis, counterweights, optimization, CNC, and other tools and techniques.

Apr. 1981 Mar. 1984	**Ingersoll-Rand, Inc., Small Compressor Division Campbellsville, Kentucky.**
Mar. 1982 Mar. 1984	**Technical Supervisor.** Managed Development and later Product Engineering departments – small scroll and reciprocating air compressors. Introduced "Energair" and Chargair" reciprocating product lines.
Apr. 1981 Mar. 1982	**Development Engineer.** Reciprocating and scroll air compressor development. Laboratory testing, computer analysis, counterweight design, load analysis, mechanical design, compressor sizing, and valve design.

Dec. 1978 Dec. 1980	**Tennessee Technological University, Dept. of Mechanical Engineering Cookeville, Tennessee.**
	Research Graduate Assistant. Research on regenerative blower noise reduction under grant from Rotron, Inc. of Woodstock, NY. Achieved 10 dB reduction with no performance loss. Client put recommendations into production.

Aug. 1976 Sep. 1977 and June 1974 July 1975	**E.I. DuPont de Nemours, Inc., Brevard, North Carolina.** **Engineering Co-op.** Provided technical, design, and production engineering support for the finishing area process control and development group in the manufacture and inspection of medical X-ray film
July 1973 Sep. 1980	**Part-Time.** Held a variety of temporary jobs, including dishwasher, convenience store clerk, farm hand, drafter, seminar assistant, contract vibration testing, and other odd jobs. Earned 100 percent of undergraduate and graduate expenses.

Personal	Spouse's Name Catherine Two Children, ages 10 and 12. Hobbies include private pilot, badminton, electric and mechanical clock repair and restoration, general and auto mechanics, antique gunsmithing, reading,, camping, and hiking.

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6,354,821 **SCROLL COMPRESSOR WITH DUAL CLUTCH CAPACITY MODULATION,** Greg W. Hahn, Carlos Zamudio, Joe T. Hill, Zili Sun, Jason Hugenroth, Thomas Barito, John R. Williams, James W. Bush, 3/12/2002 (Scroll Technologies).

6,352,417 **OPTIMIZED RADIAL COMPLIANCE FOR A SCROLL COMPRESSOR,** Carlos Zamudio, Joe T. Hill, Greg W. Hahn, Zili Sun, Jason Hugenroth, Thomas Barito, John R. Williams, James W. Bush, 3/5/2002 (Scroll Technologies).

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6,309.198 **SCROLL COMPRESSOR WITH IMPROVED OIL FLOW,** Carlos Zamudio, Zili Sun, Jason Hugenroth, Greg Hahn, Thomas Barito, James W. Bush, Joe T. Hill, John R. Williams, 10/30/01 (Scroll Technologies).

6,309,197 **SCROLL COMPRESSOR WITH AXIALLY FLOATING NON-ORBITING SCROLL AND NO SEPARATOR PLATE,** James W. Bush, Zili Sun, Carlos Zamudio, Jason Hugenroth, Greg Hahn, Thomas Barito, Joe T. Hill, John R. Williams, 10/30/01 (Scroll Technologies).

6,293,776 **METHOD OF CONNECTING AN ECONOMIZER TUBE,** Greg Hahn, Zili Sun, Carlos Zamudio, Jason Hugenroth, Thomas Barito, James W. Bush, Joe T. Hill, John R. Williams, 9/25/01 (Scroll Technologies).

6,280,146 **SEALED COMPRESSOR USING HOT OIL TO ACTIVATE PROTECTOR SWITCH,** James W. Bush, Zili Sun, Carlos Zamudio, Jason Hugenroth, Greg Hahn, Thomas Barito, Joe T. Hill,. and John R. Williams, 8/28/01 (Scroll Technologies).

6,257,851 **GENERALIZED MINIMUM DIAMETER SCROLL COMPONENT,** James W. Bush, Wayne P. Beagle, Mark E. Housman, 7/10/01 (Scroll Technologies).

6,217,302 **FLOATING SEAL BIAS FOR REVERSE RUN PROTECTION IN SCROLL COMPRESSOR,** Zili Sun, Carlos Zamudio, Jason Hugenroth, Greg Hahn, Thomas Barito, James W. Bush, Joe T. Hill, and John R. Williams, 4/17/01 (Scroll Technologies)

6,196,816 **UNEQUAL INJECTION PORTS FOR SCROLL COMPRESSORS,** Alexander Lifson and James W. Bush, 3/6/01 (Carrier)

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6,171,086 **SCROLL COMPRESSOR WITH PRESSURE EQUALIZATION GROOVE,** Alexander Lifson and James W. Bush, 1/9/01 (Carrier).

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6,139,299 **CONJUGATE SCREW ROTOR PROFILE,** Keshava B. Kumar and James W. Bush, 10/31/00 (Carrier).

6,120,268 **SCROLL COMPRESSOR WITH REVERSE OFFSET AT WRAP TIP,** James W. Bush and Alexander Lifson, 9/19/00 (Carrier).

6,113,372 **SCROLL COMPRESSOR WITH DISCHARGE CHAMBER GROOVE,** Alexander Lifson and James W. Bush, 9/5/00 (Carrier).

6,089,839 **OPTIMIZED LOCATION FOR SCROLL COMPRESSOR ECONOMIZER INJECTION PORTS,** James W. Bush and Alexander Lifson, 7/18/00 (Carrier).

6,074,186 **LUBRICATION SYSTEMS FOR SCROLL COMPRESSORS,** Alexander Lifson, Hussein Ezzat Khalifa, and James W. Bush, 6/13/00 (Carrier).

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5,869,914 **PILOTED ASSEMBLY,** David C. Baumann and James W. Bush, 2/9/99 (Carrier).

5,857,844 **SCROLL COMPRESSOR WITH REDUCED HEIGHT ORBITING WRAP,** Alexander Lifson and James W. Bush, 1/12/99 (Carrier).

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5,772,416 **SCROLL-TYPE MACHINE HAVING LUBRICANT PASSAGES,** Jean-Luc M. Caillat and James W. Bush, 6/30/98 (Copeland).

5,758,404 **METHOD OF ASSEMBLING A MOTOR,** David C. Baumann and James W. Bush, 6/2/98 (Carrier).

5,745,992 **METHOD OF MAKING A SCROLL-TYPE MACHINE,** Jean-Luc M. Caillat, Roger C. Weatherston, and James W. Bush, 5/5/98, (Copeland).

5,582,512 **COMPACT OLDHAM COUPLING,** James W. Bush, 12/10/98, (Carrier).

5,511,389 **ROTARY COMPRESSOR WITH LIQUID INJECTION,** James W. Bush, Alexander D. Leyderman, and Donald Yannascoli, 4/30/96, (Carrier).

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5,391,054	**COMPRESSOR END SHELL**, James W. Bush, 2/21/95, (Carrier).
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5,295,813	**SCROLL-COMPRESSOR HAVING FLAT DRIVING SURFACES**, Jean-Luc M. Caillat, Roger C. Weatherston, and James W. Bush, 3/22/94, (Copeland).
5,281,114	**DYNAMICALLY BALANCED CO-ORBITING SCROLLS**, James W. Bush, 1/25/94, (Carrier).
5,219,281	**FLUID COMPRESSOR WITH LIQUID SEPARATING BAFFLE OVERLYING THE INLET PORT**, Jean-Luc M. Caillat, Roger C. Weatherston, and James W. Bush, 6/15/93, (Copeland).
5,197,868	**SCROLL-TYPE MACHINE HAVING A LUBRICATED DRIVE BUSHING**, Jean-Luc M. Caillat, Roger C. Weatherston, and James W. Bush, 3/30/93, (Copeland).
5,178,526	**COUPLING MECHANISM FOR CO-ORBITING SCROLL MEMBERS**, Christopher R. Galante and James W. Bush, 1/12/93, (Carrier).
5,174,738	**SLIDER BLOCK FOR A SCROLL COMPRESSOR HAVING EDGE LOADING RELIEF UNDER LOAD**, David C. Baumann, Edward A. Tomayko, James W. Bush, and Antonio Prince, 12/29/92, (Carrier).
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